Chapter Two
AVIATION DEMAND FORECASTS

CHANDLER MUNICIPAL AIRPORT
AIRPORT MASTER PLAN

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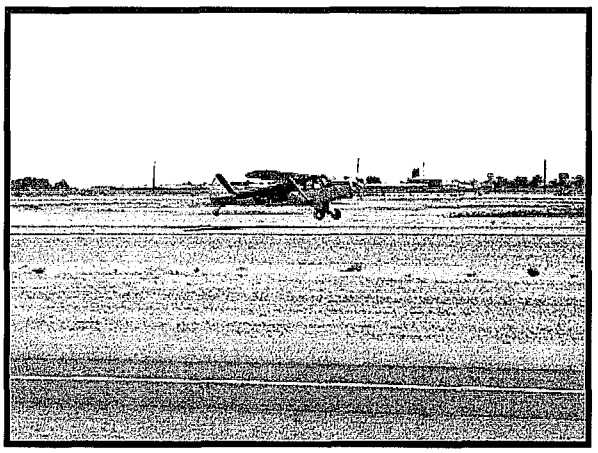
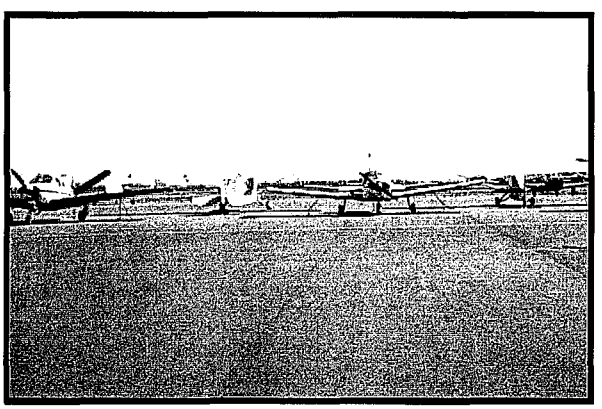


The proper planning of a facility of any type must begin with a definition of the need that it can reasonably expect to serve over the specified planning period. At Chandler Municipal Airport, this involves the development of a set of forecasts that best define the potential of future aviation demand. Forecasts of the airport can then be used as a basis for determining the types and sizes of aviation facilities required to accommodate the aviation needs of the Chandler area through the year 2020.

Forecasts are applied to several phases of the master plan study. Initially, they are used to analyze the capacity of the airfield, the terminal areas, and the access system serving the airport. They are also used to evaluate the airport's role in regional, state, and national airport systems and from that, the need for new or improved navigational systems. They can also be used in the evaluation of the financial feasibility of alternative development actions. In addition, they are applied to noise analysis to assist in developing recommendations for compatible land use around the airport.

The primary objective of a forecasting effort is to define the magnitude of change that can be expected over time. Because of the cyclical nature of the economy, it is virtually impossible to predict with certainty year-to-year fluctuations in activity when looking twenty years into the future. However, a trend can be established which delineates long-term growth potential. While a single line is often used to express the anticipated growth, it is important to remember that actual growth may fluctuate above and below this line. The point to remember about forecasts is that they serve only as guidelines, and planning must remain flexible to respond to unforeseen



facility needs. This is because aviation activity is affected by many external influences, as well as by the types of aircraft used and the nature of available facilities.

Recognizing this, it is intended to develop a master plan for Chandler Municipal Airport that will be demand-based rather than time-based. As a result, the reasonable levels of activity potential that are derived from this forecasting effort will be related to the planning horizon levels rather than dates in time. These planning horizons will be established as levels of activity that will call for consideration of the implementation of the next step in the master plan program.

Aviation activity is affected by many outside influences, as well as by the equipment and facilities available. Few industries have seen the dynamic changes the aviation industry has seen since the first powered flight. Major technological breakthroughs, as well as regulatory and economic actions, have resulted in erratic growth patterns and have had significant impacts upon activity at most airports. The following sections attempt to define the historical trends and discuss how other influences may affect future trends in establishing forecasts of aviation activity for Chandler Municipal Airport.

FORECASTING METHODOLOGY

The systematic development of aviation forecasts involves both analytical and judgmental processes. A series of mathematical relationships are tested to establish statistical logic and rationale for projected growth. The judgement of the forecast analyst, based upon professional experience and knowledge of the situation, is important to the final determination of the selected forecast.

The most reliable approach to estimating aviation demand is through the utilization of more than one analytical technique. Methodologies frequently considered include regression analysis and market share analysis.

The analysis begins with an assessment of historical trends as data is collected and sorted on a variety of aviation indicators at the local, regional, and national level. Data on aviation related factors such as based and registered aircraft, aircraft fleet mix, and aircraft operations was collected. Similarly, socioeconomic factors such as population, income, and employment are also considered for their effect on aviation activity. The identification and comparison of the relationships between these various indicators provides the initial step in the development of realistic forecasts of aviation demand.

Regression analysis measures statistical relationships between dependent and independent variables yielding a "correlation coefficient". The correlation coefficient (Pearson's "r") measures association between the changes in a dependent variable and independent variable(s). The higher the "r" value, the more likelihood that the variables are related in some manner. A perfect correlation would be 1.0, however, an "r" value of greater

than 0.90 indicates a good correlation between the variables. Lower "r" values can be, and are often used, but it should be recognized that the correlation, and therefore, the reliability is not as strong. Two types of regression analyses are often used in forecasting aviation demand: trendline projection and correlation analysis.

Trendline projection is probably the simplest and most familiar of the forecasting techniques. By fitting classical growth curves to historical demand data, then extending them into the future, a basic trendline projection is produced. Because the dependent variable (time) grows at a constant rate, a basic assumption of this technique is that outside factors will continue to affect aviation demand in much the same manner as in the past. As broad as this assumption may be, the trend line projection does serve as a reliable benchmark for comparing other projections. It is also important to remember that this methodology is time sensitive and only as accurate as the data entered into the formula.

Correlation analysis provides a measure of direct analysis between two or more separate sets of historical data such as population and based aircraft. The analysis is run in order to determine whether a change in one data set (independent variable) has historically reflected a corresponding change in the other (dependent variable). Should a reasonable correlation between the two data sets be determined ("r" value greater than 0.90), a regression analysis can then be employed to forecast changes to one of the data sets.

Another method commonly utilized in forecasting aviation elements is a ***market share analysis***. This method involves a historical review of the airport activity as a percentage, or share, of the larger regional, state, or national aviation market. A historical market share trend is determined providing an expected market share for the future. These shares are then multiplied by the forecasts of the larger geographical area to produce a market share projection. This method has the same limitations as regression analysis tools, but can provide a useful check on the validity of other forecasting techniques.

A number of studies were utilized in preparing aviation forecasts for the Chandler Municipal Airport. Information was obtained from available studies concerning the airport and Maricopa County area, including the previous **Airport Master Plan Update** (1982), the Maricopa Association of Governments (MAG) **Regional Aviation System Plan Implementation Study** (1996), figures from the **Draft 2000-2020 Household, Resident Population in Households and Employment Projections**, the **1995 Arizona State Aviation Needs Study**, and the **FAA Aviation Forecasts-Fiscal Years 1996-2007**. Using a broad spectrum of these local, regional, and national socioeconomic and aviation trends, forecasts were developed.

NATIONAL AVIATION TRENDS

Each year, the Federal Aviation Administration (FAA) publishes its

national aviation forecast. Included in this publication are forecasts for air carriers, air taxi/commuters, general aviation, and military activity. The forecasts are prepared to meet budget and planning needs of the constituent units of the FAA and to provide information that can be used by state and local authorities, the aviation industry, and the general public. The current edition when this set of forecasts were prepared was **FAA Aviation Forecasts-Fiscal Years 1996-2007**. The forecasts use the economic performance of the United States as an indicator of future aviation industry growth in the United States. Similar economic analyses are applied to the outlook for aviation growth in international markets.

For the U.S. aviation industry, the outlook for the next twelve years is for moderate to strong economic growth, moderately increasing fuel prices, and moderate inflation. Based on these assumptions, aviation activity by fiscal year 2007 is forecast to increase by 19.5 percent at towered airports and 26.8 percent at air route traffic control centers. The active general aviation fleet is projected to decline for the next few years then begin to rebound for a net increase of 4.9 percent. General aviation hours flown are forecast to increase by 9.9 percent during the same period.

Historically, the economic cycle of the general aviation industry closely paralleled that of the national economy. For more than a decade, however, general aviation has been in a state of decline. A number of events have factored into this extended decline. These have included the deregulation of the airline industry, increases in airspace restrictions for visual flight rule (VFR) only aircraft, reductions in leisure time, and shifts in personal preferences for goods, services, and leisure time. The overriding factor, however, has been the increased cost in owning and operating a general aviation aircraft.

There are still, however, a number of reasons to maintain a favorable outlook of the general aviation industry. One is the passage of the General Aviation Revitalization Act of 1994. This legislation limits the liability on general aviation aircraft to 18 years from the date of manufacture. This has sparked an interest in aircraft manufacturers to renew the manufacturing of general aviation aircraft due to the reduction in product liability. The high cost of product liability insurance was a major factor in manufacturers decisions to slow or even discontinue general aviation aircraft production.

Since the enactment of this legislation in August 1994, Cessna aircraft has committed to resume the production of selected single engine piston aircraft and Piper has announced plans to increase its production level. In addition, the amateur-built aircraft market has shown steady growth over the past several years. General aviation aircraft shipments were up 12.9 percent in 1995 reversing a six-year decline in aircraft shipments. Most notable about this increase was that it occurred across all aircraft types.

Other reasons for a more favorable long range outlook for general aviation is a growing realization that the industry must "reinvent" itself. As a result,

several federal, manufacturer, and industry programs have been initiated. Among these is the FAA's recent streamlining of the small aircraft certification process to include a new entry-level aircraft (Primary Category Rule) that could encourage the production of small, affordable aircraft.

Eleven general aviation organizations have formed a coalition in support of the implementation of the FAA's General Aviation Action Plan. This action plan has goals to seek to provide for regulatory relief and reduced user costs, improved delivery of services through reduced layers of management and more communication, elimination of unneeded programs and processes, and encouragement of product innovation and competitiveness.

Manufacturer and industry programs include the "No Plane No Gain" program promoted jointly by the General Aviation Manufacturers and The National Business Aircraft Association. This program is designed to promote the use of general aviation aircraft as an essential tool of business. Other programs are intended to promote growth in the number of new pilot starts and general flying and introduce people to general aviation. These include the Aircraft Owners and Pilots Association "Project Pilot", the National Air Transportation Association's "Learn to Fly" program, and the Experimental Aircraft Association's "Young Eagles" program.

The most notable trend in general aviation is the continued strong use of general aviation aircraft for business and corporate uses. In 1994, the number of hours flown by the combined use categories of business and corporate flying represented 23.3 percent of total general aviation activity. In 1990, the number of hours flown by the combined use categories of business and corporate flying represented 21.8 percent of total general aviation activity.

As a result of continued strong use of general aviation aircraft for business and corporate uses, the character of the general aviation fleet has been changing from a fleet consisting mostly of small piston-powered aircraft to a fleet made up of more sophisticated turbine powered aircraft. Reflecting the increasing convenience of general aviation flying to business and the move towards more sophisticated, turbine powered aircraft, FAA long-term projections show this segment of general aviation growing more rapidly than all others. FAA forecasts project the active turbine-powered fleet growing 1.5 percent annually through the year 2007. This includes the number of turboprop aircraft growing from 4,207 in 1995 to 5,000 in 2007 and the number of turbojet aircraft increasing from 4,073 in 1995 to 4,900 in 2007.

A trend in the type of general aviation operations at FAA-towered airports and the number of general aviation aircraft handled at FAA enroute traffic control has also emerged. General aviation operations at both locations have registered increases in the past two years reflecting an increased use of technologically advanced, sophisticated aircraft in adverse weather conditions. General aviation instrument operations at towered airports were up 1.9 percent in 1994 and 0.6 percent in 1995. The number of general aviation aircraft

handled at en route centers was up 2.7 percent in 1994 and 3.9 percent in 1995.

Overall, the active general aviation aircraft fleet is expected to decline for the next few years then begin to grow slowly. The aging piston-engine portion of the active aircraft fleet is the primary reason for the short term decline in active aircraft. The average age of the active aircraft fleet is 27 years with piston aircraft accounting for most of the aging aircraft. While new aircraft orders are increasing, the retirement of older aircraft will be higher for a few years, resulting in a net decline. Piston aircraft are anticipated to have a net increase of 3,300 units in the active fleet by 2007. **Exhibit 2A** depicts the FAA forecast for active general aviation aircraft in the United States.

AIRPORT SERVICE AREA

The initial step in determining aviation demand for an airport is to define its generalized service area for the various segments of aviation the airport can accommodate. The airport service area is determined primarily by evaluating the location of competing airports, their capabilities and services, and their relative attraction and convenience. With this information, a determination can be made as to how much aviation demand would likely be accommodated by a specific airport. It should be recognized that aviation demand does not necessarily conform to political or geographical boundaries.

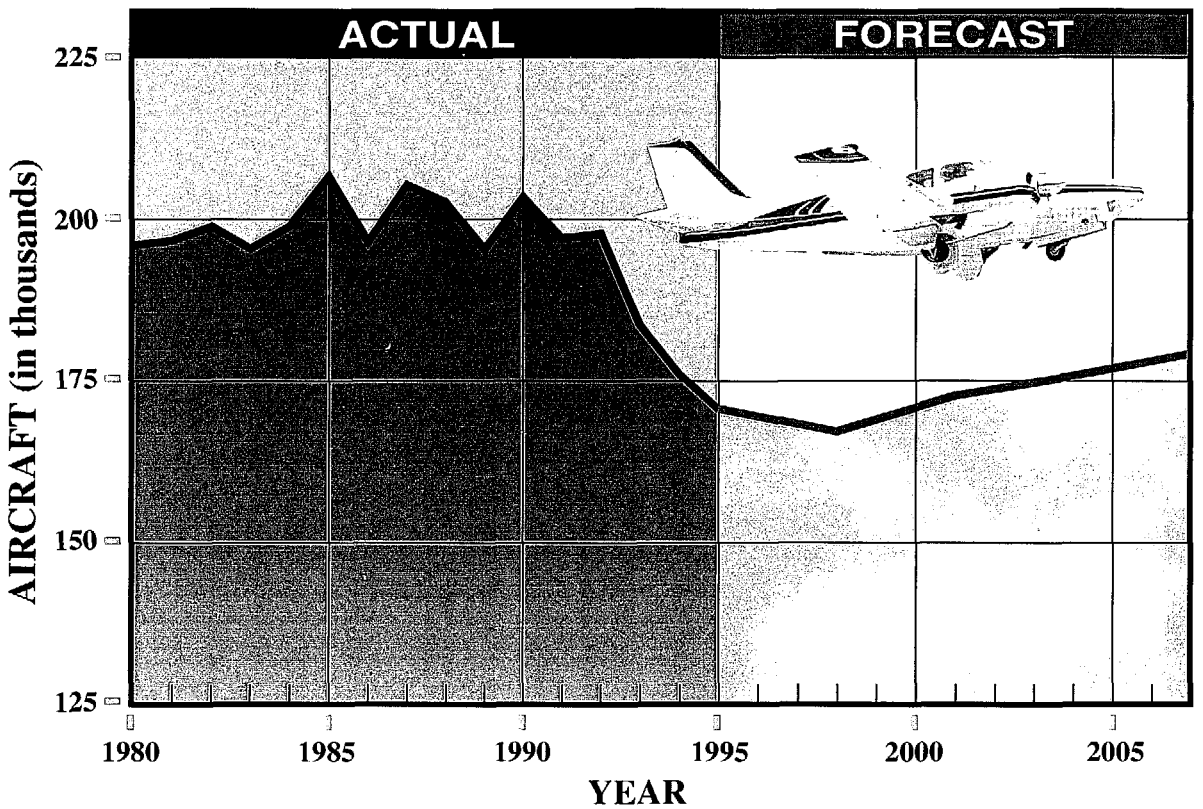
The airport service area is an area where there is a potential market for airport services. Access to general aviation airports, commercial air service, and transportation networks enter into the equation that determines the size of a service area, as well the quality of aviation facilities, distance, and other subjective criteria.

As in any business enterprise, the more attractive the facility is in services and capabilities, the more competitive it will be in the market. As the level of attractiveness expands, so will the service area. If an airport's attractiveness increases in relation to nearby airports, so will the size of the service area. If facilities are adequate and rates and fees are competitive at Chandler Municipal Airport, some level of general aviation activity might be attracted to the airport from surrounding areas.

In determining the aviation demand for an airport it is necessary to identify the role of that airport. The primary role of the Chandler Municipal Airport is to serve the needs of general aviation. General aviation is a term used to describe a diverse range of aviation activities which includes all segments of the aviation industry except commercial air carriers and military.

A description of nearby general aviation airports was previously completed in **Chapter One** which included descriptions of nearby Williams Gateway, Stellar Airpark, Mesa-Falcon Field, and other Phoenix area public-use airports. The service area for the Chandler Municipal Airport is, and will continue to be defined primarily by the location of other general aviation airports in the Phoenix metropolitan area.

ACTIVE GENERAL AVIATION AIRCRAFT



U.S. ACTIVE GENERAL AVIATION AIRCRAFT (in thousands)

As of January 1	FIXED WING				ROTORCRAFT				
	PISTON		TURBINE						
	Single Engine	Multi-Engine	Turboprop	Turbojet	Piston	Turbine	Experimental	Other	Total
1995	123.3	15.6	4.2	4.1	1.4	3.0	12.9	6.2	170.6
1998	119.0	15.1	4.4	4.3	1.3	3.0	13.5	6.7	167.3
2001	122.6	15.5	4.6	4.5	1.2	3.0	14.1	7.0	172.5
2004	124.5	15.6	4.8	4.7	1.1	3.0	14.6	7.4	175.7
2007	126.4	15.8	5.0	4.9	1.1	3.0	15.0	7.7	178.9

Source: FAA Aviation Forecasts, Fiscal Years 1996-2007.

Notes: Detail may not add to total because of independent rounding. An active aircraft must have a current registration and it must have been flown at least one hour during the previous calendar year.

Exhibit 2A
U.S. ACTIVE GENERAL AVIATION
AIRCRAFT FORECASTS

As mentioned previously, the Chandler Municipal Airport is located on the eastern edge of the City of Chandler's Metropolitan Planning Area (MPA). The MPA, as depicted on **Exhibit 2B**, includes the City's corporate limits, strip annexation, and extra territory bounds delineated through agreements with surrounding communities.

Also indicated on the exhibit is the MPA limits for the Town of Gilbert, which borders the airport to the east. Although the airport service area does not exactly follow lines on a map, the airport's demand is driven primarily by the Chandler and Gilbert MPA's.

The airport's draw from the areas to the north (Mesa, Tempe, etc.) is less because of the availability of other airports providing similar services in closer proximity to those areas. The airport also serves areas to the south such as Sun Lakes. Effectively, the current and future service area for general aviation services at Chandler Municipal Airport is limited to the southeastern portion of the Phoenix metropolitan area, with the large majority of demand coming specifically from the City of Chandler and Town of Gilbert MPA's, Sun Lakes, and smaller communities to the south.

The growth of the Phoenix metropolitan area, including the City of Chandler and the Town of Gilbert has been strong with little indication that it will significantly slow in the future. Urban development outward towards the Chandler Municipal Airport, is likely to continue as well. Urban growth towards the airport will tend to increase user demand at Chandler Municipal Airport because aircraft owners generally elect to base their aircraft nearer their residences. Williams Gateway and Memorial Field share portions of the Chandler Municipal Airport service area. Therefore, the forecast analysis conducted in the following sections will take into consideration these nearby facilities.

SOCIOECONOMIC PROJECTIONS

Local socioeconomic forecasts provide an indication of the potential for sustaining growth in aviation activity over the planning period. For the sake of this forecasting effort, historical socioeconomic data for the City of Chandler and Town of Gilbert were obtained. Both Chandler and Gilbert have defined growth boundaries (MPA's) that include areas not currently incorporated, so population and employment data pertaining to these MPA's was also collected.

POPULATION

Between 1980 and 1996, the population of the City of Chandler increased by almost five fold from 29,673 to 143,505. This equates to an average annual growth rate of 10.4 percent. The Town of Gilbert has experienced an even higher growth rate, expanding from 5,717 in 1980 to 72,000 as estimated in January, 1997. This increase equates to an average annual growth rate of 16.1 percent.

Resident population for the Sun Lakes area increased from 5,127 in 1990 to 9,037 in 1995 which equates to an average annual increase of 12.0 percent.

The resident population for the Sun Lakes area is expected to grow at a slower pace in the future as it reaches its "build-out" level of 14,948 residents by 2015. This equates to an average annual resident population increase of 2.5 percent over the twenty year period.

Since the airport service area is made up primarily of the Chandler and Gilbert MPA's, growth for these areas was examined. Historical and forecast information presented in **Table 2A** include resident population in households only. By comparison, the population for Chandler and Gilbert discussed above is total resident population. Resident population in households differs from total resident population figures because group quarter population (inmates in prisons, military barracks) are not included in the count.

TABLE 2A
Historical and Forecast Resident Population in Households
City of Chandler MPA, Town of Gilbert MPA, and Maricopa County

Year	Chandler MPA	Gilbert MPA	Maricopa County
Historical			
1990	95,763	35,706	2,122,101
1995	134,390	65,277	2,551,765
Forecast			
2000	168,730	109,052	2,954,150
2005	193,952	133,939	3,271,667
2010	215,737	168,633	3,644,571
2015	234,603	191,057	4,028,968
2020	255,140	212,834	4,434,075

Source: 1990 numbers from MAG Update of the *Population and Socioeconomic Database for Maricopa County, Arizona, March 1993*, Table 4-6; 1995 and forecast figures are considered draft as they are from the *Draft 2000-2020 Household, Resident Population in Households and Employment Projections*.

Resident population in households for the Chandler and Gilbert MPA's has experienced sizable increases. Between 1990 and 1995, the household population for Chandler MPA has increased by 38,627 residents for an average annual growth rate of 7.0 percent. Over the same period, household population for the Gilbert MPA has increased by 29,571 residents for an average annual growth rate of 12.8 percent. During the same period, household population for Maricopa County has increased by 387,711 residents for an average annual growth rate of 3.5 percent. The combined resident household population growth for the City of Chandler and Town of Gilbert MPA's constituted 17.6 percent of the county's household population

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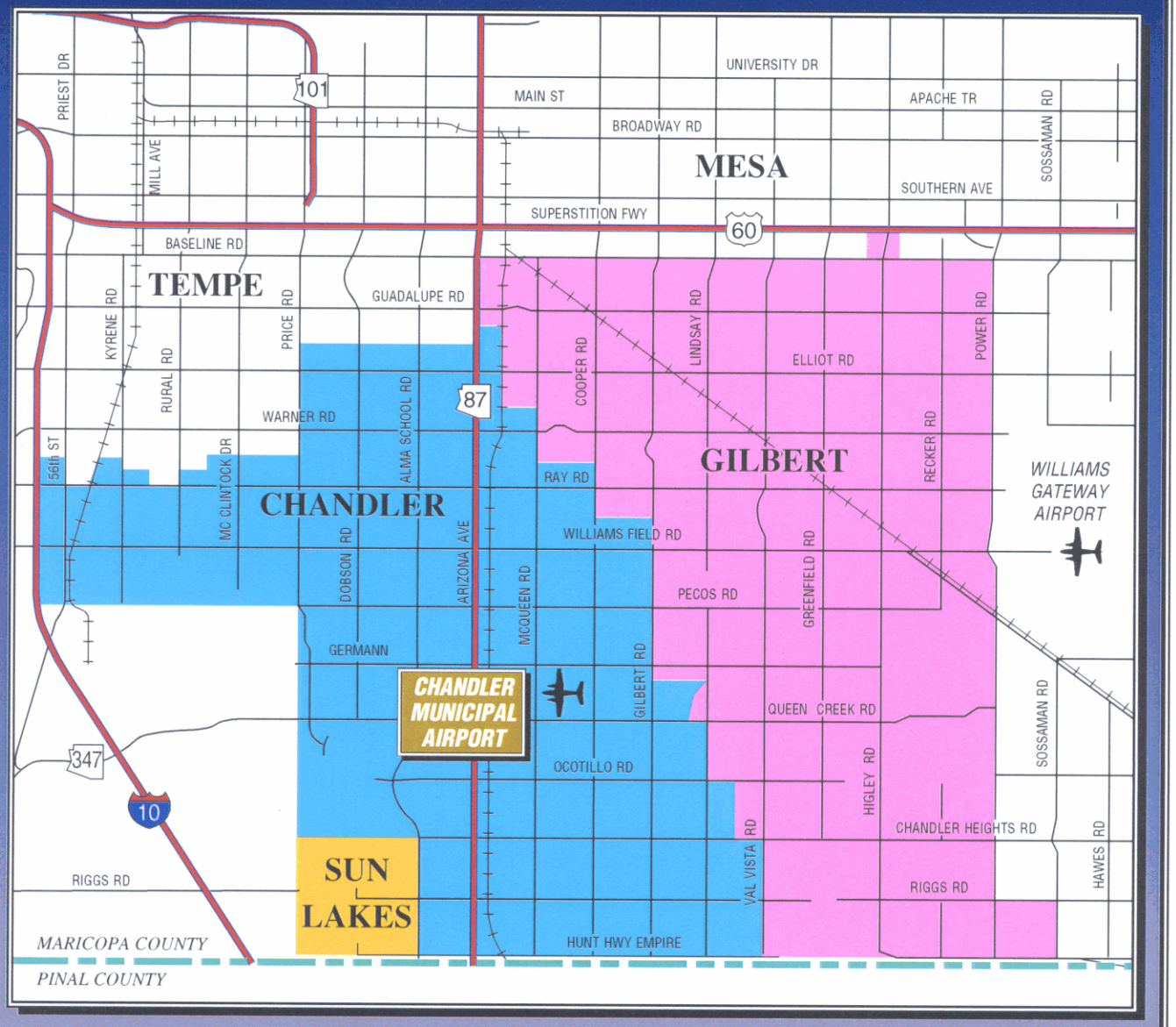

LEGEND

- City of Chandler MPA
- Town of Gilbert MPA
- Sun Lakes

NORTH

NOT TO SCALE

Exhibit 2B
AIRPORT SERVICE AREA

increase between 1990-1995. Because the Sun Lakes area is a planned residential community, its total resident population is equal to its household population.

As indicated by the table, household population increases for the Chandler and Gilbert MPA's are expected to continue to be strong, but slowing growth rates through 2020, reaching 255,140 and 212,834 respectively. The projections equate to an average annual growth rate of 2.6 percent for the Chandler MPA and 4.8 percent for the Gilbert MPA. By comparison, the household population for Maricopa County is projected to increase at an average annual rate of 2.3 percent.

EMPLOYMENT

Employment projections can be a useful tool in determining aviation demand at an airport, especially demand generated by corporate use. As the employment base increases, the use of the local airport by local corporations increases as well. **Table 2B** presents historical and forecast employment figures prepared by MAG.

TABLE 2B
Historical and Forecast Employment
City of Chandler MPA, Town of Gilbert MPA, and Maricopa County

Year	Chandler MPA	Gilbert MPA	Maricopa County
Historical			
1990	29,118	6,060	975,037
1995	47,288	16,836	1,264,800
Forecast			
2000	65,305	22,138	1,506,620
2005	80,387	28,502	1,714,721
2010	94,410	35,972	1,928,977
2015	105,810	42,734	2,091,901
2020	117,011	49,145	2,258,047

Source: 1990 numbers from MAG Update of the *Population and Socioeconomic Database for Maricopa County, Arizona, March 1993*, Table 4-6; 1995 and forecast figures are considered draft as they are from the *Draft 2000-2020 Household, Resident Population in Households and Employment Projections*.

As indicated on the table, employment increases for the Chandler and Gilbert MPA's has mirrored the strong population increases. Between 1990 and 1995, employment for the Chandler MPA increased by 18,170 jobs, equating to an average annual growth rate of 10.2 percent. The Gilbert MPA employment has increased by 10,776 jobs and an average annual growth rate of 22.7 percent over the same period. Employment for Maricopa County has

increased at a slower annual rate than the Chandler and Gilbert MPA's, increasing by 289,763 jobs or 5.3 percent on an average annual basis. The combined employment growth for the Chandler and Gilbert MPA's equates to 10 percent of the county's total employment growth.

Forecast employment for the Chandler and Gilbert MPA's is expected to follow a strong growth pattern. Employment for the Chandler MPA is projected to increase at an average annual rate of 3.7 percent over the next 25 years, while the Gilbert MPA is expected to grow at 4.4 percent annually. Overall, Maricopa County is expected to grow at a slower rate of 2.3 percent annually.

GENERAL AVIATION FORECASTS

To determine the types and sizes of facilities that should be planned to accommodate general aviation activity, certain elements of this activity must be forecast. Indicators of general aviation demand include:

- Based aircraft
- Based aircraft fleet mix
- General aviation operations
- Peak operation activity
- Annual instrument approaches

The remainder of this chapter will examine historical trends with regard to these areas of general aviation and project future demand for these segments of general aviation activity at the airport.

BASED AIRCRAFT FORECASTS

The number of based aircraft is the most basic indicator of general aviation demand at an airport. By first developing a forecast of based aircraft, the growth of aviation activities at the airport can be projected. Historical information regarding based aircraft at the airport and Maricopa County registered aircraft was obtained from the **MAG Regional Aviation System Plan (RASP) Implementation Study (1996)** prepared for the Maricopa County Association of Governments (MAG), and the **1995 State Aviation Systems Needs Study** (**SANS**).

As indicated on **Table 2C**, 1992-1996 registered based aircraft for Maricopa County fall well below the previous years. The lower numbers reported by ADOT demonstrate that many aircraft registered in Maricopa County are not actively based there. For this reason, Arizona Department of Transportation (ADOT) decided to assign aircraft to airports based upon "N" numbers from state aircraft registrations.

The decreasing trend can also be attributed to the method utilized in reporting the data. Aircraft registrations presented in the **SANS** were researched from the FAA's **Census of U.S. Civil Aircraft.** The census publication lists all aircraft registrations reported within the county. As is often the case, aircraft owners may elect to register their aircraft within a county while not actually basing their aircraft within the same county.

Forecasts of registered aircraft for Maricopa County presented in the table indicate a return to previous levels. By 2015, MAG projects that registered aircraft for the county will reach 3,832.

TABLE 2C
Historical and Forecast Based Aircraft
Chandler Municipal Airport

Year	Maricopa County Registered Aircraft [1]	Chandler Municipal Airport Based Aircraft [2]		Percent of Maricopa County Registered Aircraft Based at Chandler
Historical				
1983	3,617	165		4.56%
1984	3,538	161		4.55%
1985	3,547	155		4.37%
1986	3,645	159		4.36%
1987	3,555	188		5.29%
1988	3,415	194		5.68%
1989	3,261	243		7.45%
1990	3,157	235		7.44%
1991	3,407	238		6.99%
1992	2,840	241		8.49%
1993	2,664	244		9.16%
1994	2,404	247		10.27%
1995	2,662	183		6.87%
1996	2,801	254		9.07%
Forecast	***MAG RASP[2]***	***MAG RASP[2]***		
2000	3,228	262	8.12%	
2005	3,404	277	8.14%	
2010*	3,619	292	8.07%	
2015	3,832	308	8.04%	
2020*	4,057	323	7.96%	

[1] Years 1983-1991 reported in 1995 State Aviation Needs Study; Years 1992-1996 Arizona DOT, Aeronautics Division

[2] 1996 MAG RASP Implementation Study; 1996 based aircraft from airport "N" number count

* 2010 & 2020 forecasts for registered and based aircraft extrapolated from MAG RASP by Coffman Associates

Historical based aircraft figures for Chandler Municipal Airport are also presented in **Table 2C**. Based aircraft have increased from 165 in 1983 to 254 in 1996. After declining between 1983 and 1985, based aircraft at the airport jumped significantly from 159 in 1986 to 243 in 1989. This has been followed by slower growth to an all time high of 254 in 1996.

It should be noted that the 1995 based aircraft figure of 183 comes from the ADOT –number registrations. The **MAG RASP Implementation Study**, thus, reflected this total as the number of based aircraft at the airport. The figure was disputed because unofficial airport counts in 1995 indicated as many as 263 based aircraft. However, ADOT requires a listing of N-numbers to officially count an aircraft as based.

On the state registrations, aircraft owners are asked to list the airport at which they are based. In some instances, however, aircraft owners only list the city or county in which they reside, thus, the aircraft is assigned to the local airport. For example, ADOT records for 1996 indicate that four DC-7 aircraft are based at the airport. These aircraft, however, are based at Memorial Field which is on the Gila River Indian Reservation. It is likely that the aircraft owner indicated Chandler as his location, thus, ADOT counted these aircraft as based at Chandler Municipal Airport. The count can also underestimate, with a prime example being rotorcraft count. ADOT records indicate that only two rotorcraft are based at the airport, while physical counts indicate at least five are based at the airport.

A recent N-number count performed by airport staff revealed there are currently 254 aircraft based on the airport. In all likelihood, the actual 1995 count was closer to this number than 183. Therefore, the 1995 figure has been discounted in the forecast analyses.

Correlation analyses were conducted for projecting future based aircraft, but the fluctuating growth of based aircraft and steady, strong growth of local socioeconomic factors did not provide any strong correlations. Therefore, based aircraft projections were developed by examining market share data, analysis of population versus based aircraft, and forecasts formulated in other studies. A trendline analysis yielded an "r" value of 0.92. The trendline projects that 487 aircraft will be based at the airport by 2020.

A market share analysis was conducted examining the existing and historical percentage of aircraft based at the Chandler Municipal Airport to registered aircraft in Maricopa County, FAA's Western Pacific Region, and U.S. Active Aircraft. Historical registered aircraft figures for Maricopa County were obtained from the Arizona Department of Aviation, Aeronautics Division and the **SANS**. As indicated in **Table 2C**, the number of aircraft registered in Maricopa County between 1983 and 1996 decreased by 816 aircraft, from 3,617 in 1983 to 2,801 in 1996.

A market share comparison of based aircraft totals at Chandler Municipal Airport to registered aircraft in Maricopa County for the period from 1983 to 1996 is presented in **Table 2C**. Based aircraft at Chandler Municipal Airport have increased from 4.56 percent of the registered aircraft in Maricopa County in 1983 to 9.07 percent in 1996.

As mentioned earlier, MAG projects registered aircraft for Maricopa County to grow to 3,832 aircraft by 2015, which would equate to a 2.3 annual percentage growth rate from the 1996

figure of 2,801. This forecast has a much higher growth rate than the national forecasts of general aviation active aircraft. The registered aircraft forecasts also compare favorably to forecast household population in Maricopa County which is also expected to grow at an average annual rate of 2.3 percent.

Based aircraft projections developed for the **1993 MAG RASP Study** for the Chandler Municipal Airport were also examined. The **MAG RASP** study projects based aircraft at Chandler Municipal Airport to total 308 by 2015. This would relate to an annual percentage growth rate of 1.5 percent and would correlate to a 8.04 percentage share of Maricopa County based registered aircraft. If registered based aircraft forecasts for Maricopa County occur as projected and population growth of the Chandler and Gilbert MPA's occur as projected, a 8.04 percent market share is very likely. In fact, it is likely that the market share of registered aircraft will increase over the planning period. If based aircraft increase at a static 9.0 percent share, the total would be 365 by 2020. However, if local population and employment projection hold, the number of based aircraft can be expected to grow according to an increasing share of registered aircraft. An increasing share reaching 11.0 percent by 2020 would yield 443 based aircraft.

Another factor to consider is the possible relocation of FBI pilot training to the airport. The Director of Aviation Training for the FBI is considering relocation of the Bureau's flight training to the airport from Virginia because of the area's favorable weather conditions. The FBI has more than 100 aircraft and over 330 pilots. If the FBI training operation is relocated to the airport, a small portion of these aircraft can be expected to relocate to the airport. The majority of training, however, would be conducted in aircraft owned by Chandler Air Service which has a contract with the FBI for aerobatic training.

A market share analysis of regional and national aircraft totals was also conducted. **Table 2D** depicts historical and forecast aircraft for FAA's Western Pacific Region and U. S. active aircraft.

The table also presents a market share analysis of Chandler Municipal Airport's historical share of these figures.

As indicated by the table, Chandler Municipal Airport's based aircraft market share for both U.S. and Western Pacific Region active aircraft increased between 1983 and 1995. Two market share forecasts are presented in **Table 2D**.

First, a constant, or static market share of based aircraft was applied to U.S. and Western Pacific Region active aircraft forecasts. Maintaining a constant market share of U.S. active aircraft, Chandler Municipal Airport can expect 291 based aircraft by 2020. A constant share of Western Pacific aircraft would yield 278 aircraft by 2020. Based upon the past history and the tremendous growth potential of the Chandler and Gilbert MPA, it is likely that the market share of aircraft based at the airport will increase. According to the table, an increasing market share of U.S. active and Western Pacific aircraft yields 466 and 432 based aircraft respectively.

TABLE 3D
Aircraft Market Share Analysis
Chandler Municipal Airport

Year	Chandler Airport Based Aircraft	U. S. Active Aircraft	% of U. S. Active	Western PAC	% of Western PAC
1983	165	195,500	0.08%	32,000	0.52%
1984	161	199,000	0.08%	32,600	0.49%
1985	155	202,700	0.08%	35,000	0.44%
1986	159	196,500	0.08%	34,300	0.46%
1987	188	205,300	0.09%	36,100	0.52%
1988	194	202,700	0.10%	35,300	0.55%
1989	243	196,200	0.12%	34,200	0.71%
1990	235	205,000	0.11%	35,100	0.67%
1991	238	198,000	0.12%	34,700	0.69%
1992	241	198,500	0.12%	36,500	0.66%
1993	244	184,400	0.13%	31,400	0.78%
1994	247	176,000	0.14%	29,600	0.83%
1995	183	170,600	0.11%	28,200	0.65%
1996	254	N/A	N/A	N/A	N/A

FORECASTS

Year	Based Aircraft	U.S. Active	%	Western PAC	%	Based Aircraft
Constant Share						
2000	255	170,000	0.15%	28,200	0.90%	254
2005	265	176,800	0.15%	28,800	0.90%	259
2010	273	182,200	0.15%	29,500	0.90%	266
2015	282	187,700	0.15%	30,100	0.90%	271
2020	291	194,140	0.15%	30,880	0.90%	278
Increasing Share						
2000	272	170,000	0.16%	28,200	1.00%	282
2005	318	176,800	0.18%	28,800	1.10%	317
2010	364	182,200	0.20%	29,500	1.20%	354
2015	413	187,700	0.22%	30,100	1.30%	391
2020	466	194,140	0.24%	30,880	1.40%	432

The last forecast method employed was an analysis of aircraft per 1,000 household residents. Typically, as the population of an area increases, aircraft per 1,000 residents decreases. The magnitude of the decrease can range widely. Thus, two decreasing schedules were utilized for forecasting purposes and are presented with historical aircraft per 1,000 residents in **Table 2E**.

TABLE 2E
Aircraft Per 1,000 Residents in Households
Chandler Municipal Airport

Year	Maricopa County Registered	Aircraft per 1,000 County Residents	Based Aircraft at Chandler Airport	Chandler/ Gilbert MPA Residents	Aircraft per 1,000 MPA Residents
1990	3,157	1.51	235	131,469	1.78
1995	2,662	1.07	254	199,667	1.27
Forecast of aircraft per 1,000 according to MAG RASP registered aircraft and Maricopa County Pop. Forecast					
2000	3,228	1.11	**308**	277,782	
2005	3,404	1.04	**341**	327,891	
2010	3,619	1.01	**388**	384,370	
2015	3,832	0.95	**404**	425,660	
2020	4,057	0.91	**426**	467,964	

As indicated by the table, Maricopa County Registered aircraft per 1,000 household residents in the county decreased from 1.51 in 1990 to 1.07 in 1995. Applying MAG population forecasts to the MAG RASP forecast of registered county aircraft, the aircraft per 1,000 residents decreases to 0.91 by 2020.

The forecast presented in the table applies the Maricopa County aircraft per 1,000 decreasing schedule to the forecasted population for the combined MPA household populations of Chandler and Gilbert. According to the table, this forecast indicates 426 based aircraft at Chandler Municipal Airport by 2020.

Presented in **Table 2F**, and on **Exhibit 2C** is a summary of all forecasts for based aircraft at Chandler Municipal Airport.

In all likelihood, actual activity will not follow any one of the projections exactly. It is more likely that based aircraft levels will fluctuate within the range of the projections depicted on **Exhibit 2C**. Thus, these lines serve more as a planning envelope. The planning envelope reflects a reasonable range for based aircraft at the airport. With this in mind, the time-based projections of anticipated growth should serve only as a guide. At any given time over the planning period, the actual level of based aircraft could fall within the envelope area defined by low range (constant market share of U.S. active aircraft) or the high range (trendline analysis).

Cost effective, safe, efficient, and orderly development of an airport should rely more upon actual demand at an airport than a time-based forecast figure. Thus, in order to develop a master plan that is demand-based rather than time-based, a series of planning horizon milestones have been established that take into consideration the reasonable range of based aircraft projections.

TABLE 2F
Summary of Based Aircraft Forecast
Chandler Municipal Airport

	2000	2005	2010	2015	2020
Trendline Analysis					
1983-1996 (R=0.92)	308	353	398	442	487
Constant Market Share of					
U.S. Active Aircraft	255	265	273	282	291
FAA Western Pacific Region	254	259	266	271	278
County Registered Aircraft	291	306	326	345	363
Increasing Market Share of					
U.S. Active Aircraft	272	318	364	413	466
FAA Western Pacific Region	282	317	354	391	432
County Registered Aircraft	307	340	371	402	443
Other Forecasts					
1993 MAG RASP Forecast	262	277	292	308	325
Aircraft per 1,000 Household Residents	308	341	388	404	426

The planning horizon milestones allow the airport to develop facilities according to need generated by actual demand levels. The demand-based schedule provides flexibility in development, as development schedules can be slowed or expedited according to actual demand at any given time over the planning period. The planning horizons for based aircraft that will be utilized for the remainder of this master plan are as follows:

- Short Term - 300
- Intermediate Term - 350
- Long Range - 450

BASED AIRCRAFT FLEET MIX

The based aircraft fleet mix expected to use the airport is projected in order to properly size airport facilities. The existing mix of based aircraft was determined through review of the **1996 MAG RASP Implementation Study** and on-site investigation and discussion with airport officials and lessees.

Currently, there are approximately 233 single-engine, 15 multi-engine piston, and one turbo-prop fixed wing aircraft, as well as five rotorcraft based at Chandler Municipal Airport. It is expected that single-engine piston aircraft will continue to comprise the bulk of based aircraft at the airport in the future, however, the percentage of turbine powered aircraft will likely increase. The planned industrial and population growth of the Chandler and Gilbert MPA will increase the demand for turbine aircraft over the planning period. Aircraft that could base at the airport in support of business will tend to be multi-engine piston, turboprop, or

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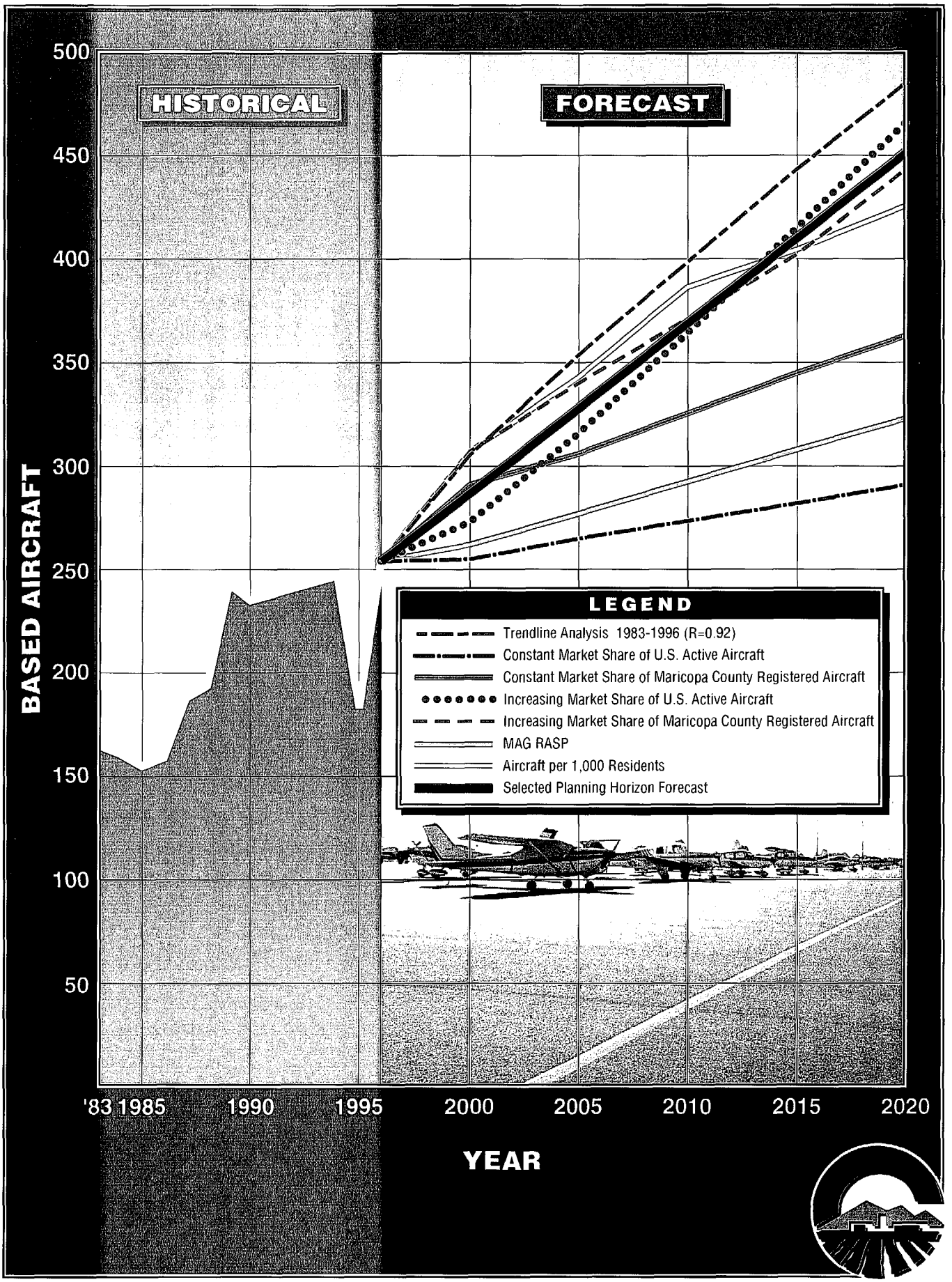

Exhibit 2C
BASED AIRCRAFT PROJECTIONS

turbojet aircraft. **Table 2G** summarizes the based aircraft fleet mix projection for the airport over the planning period.

TABLE 2G
Based Aircraft Fleet Mix
Chandler Municipal Airport

Year	Total	Single-Engine	Multi-Engine	Turboprop	Jet	Rotor
1990	235	207	18	2	0	7
1991	238	210	18	2	0	7
1992	241	213	18	3	0	7
1993	244	215	18	3	1	7
1994	247	216	19	3	1	8
1995	183	N/A	N/A	N/A	N/A	N/A
1996	254	233	15	1	0	5
Forecast						
Short Term	300	267	19	4	1	9
Intermediate	350	304	22	8	4	12
Long Range	450	380	30	15	8	17

Source: 1990-1995 from 1996 MAG RASP Implementation Study; 1996 airport count estimate

ANNUAL GENERAL AVIATION OPERATIONS

There are two types of general aviation operations at an airport: local and itinerant. A local operation is a take-off or landing performed by an aircraft that operates in the traffic pattern or executes simulated approaches or touch-and-go operations. More simply stated, they are primarily training operations. Itinerant operations are those performed by an aircraft with a specific origin or destination away from the airport. Typically, itinerant operations increase with business and industry use since business aircraft are used primarily to carry people from one location to another.

Since the air traffic control tower (ATCT) at the airport was not activated until June 22, 1995, an accurate historic count of aircraft operations before that time is not available. Only general estimates of activity based on traffic observations are available before 1995.

As indicated on **Table 2H**, the airport has experienced a 21.8 percent increase in total operations between 1996 and 1998, with local operations equaling more than 60 percent of annul operations. It should be noted that the ATCT operates from 6:00 a.m. to 9:00 p.m., thus operations at the airport during nighttime hours are not counted. From review of activity at

other airports in the area, it can be estimated that nighttime operations comprise up to three percent of annual operations. Thus, total 1998 (June 1997 through May 1998) annual operations are probably closer to 195,900. This adjustment will need to be accounted for when examining airfield capacity and noise exposure. However, the tower count will be utilized to express the planning horizon milestones in the future, because it will be readily available as a benchmark of operational activity.

TABLE 2H
Historical General Aviation Operations
Chandler Municipal Airport

Year	Itinerant Operations	Local Operations	Total Operations	Based Aircraft	Operations per Based Aircraft
1996	60,981	95,228	156,209	250	625
1998*	68,738	121,454	190,192	250	761
Actual Monthly Traffic Counts for 1996 by Air Traffic Control Tower					
Jun. 1997	5,172	8,761	13,933		
Jul. 1997	5,102	10,032	15,134		
Aug. 1997	4,928	8,480	13,408		
Sept. 1997	4,830	8,033	12,863		
Oct. 1997	5,955	10,195	16,150		
Nov. 1997	6,392	10,577	16,969		
Dec. 1997	5,492	10,219	15,711		
Jan. 1998	6,200	10,977	17,177		
Feb. 1998	5,633	9,436	15,069		
Mar. 1998	6,468	12,448	18,916		
Apr. 1998	6,524	11,302	17,826		
May 1998	6,042	10,994	17,036		

* Source: June 1997 through May 1998 operations from ATCT traffic counts.

Because historic operation levels are only estimates until 1995 and have fluctuated greatly over the five year period, statistical regression tests provided no reasonable correlations. For this reason, aircraft operations as a ratio of based aircraft were examined for use in forecasting future operations. According to **Table 2H**, operations per based aircraft for 1996 was 625. In 1998, operations per based aircraft increased to 761.

Typically, operations per based aircraft can range between 300 and 800 at airports similar to Chandler Municipal Airport. Airport's with high training, or local operations will have a higher operation per based aircraft ratio, whereas, airport's utilized by a higher percentage of transient aircraft will have lower ratios.

For example, Mesa-Falcon Field and Phoenix Deer Valley Airports historic-

ally have averaged between 300 and 400 operations per based aircraft. These airport experience a high percentage of local operations, however, they have more than twice as many based aircraft and only 50,000 additional operations. Glendale Municipal Airport, however, also has a high local operation percentage but averaged 691 operations per based aircraft in 1995.

For forecasting purposes, two forecasts of operations per based aircraft were developed. First, a constant, or static level of 700 operations per based aircraft was applied to each planning horizon level. As a result, the long range planning horizon operational level would equal 315,000.

Training operations could, however, increase slightly as more Phoenix area pilots based at other airports utilize Chandler Municipal Airport for training purposes or if the FBI training operation is relocated to the airport. Also, FAA forecasts indicate that operations will increase at a faster percentage rate than active aircraft. Thus, an increasing operation per based aircraft forecast was also developed. It is reasonable to assume that the operation per based aircraft ratio could reach 800 by the end of the planning period. If this were to occur, total operations for the long range planning horizon would reach 360,000.

Another technique utilized for projecting future operational levels is forecasting according to an average annual growth rate. According to **FAA Aviation Forecasts-Fiscal Years 1996-2007**, the FAA projects that total general aviation operations at contract towered airports will increase on an average annual basis of 2.12 percent. Projecting total annual operations at the airport using the FAA projection of a 2.12 percent annual growth rate yields 301,800 operations in 2020.

It would be reasonable to assume that operations at the airport will grow at a rate higher than the national average because based aircraft numbers are projected to increase, the FBI flight training operation could relocate to the airport, and the proposed industrial park may attract additional aircraft operations. The airport can expect to increase on an average annual basis of between two and three percent as population and employment in the Chandler and Gilbert MPA's increase and aircraft operators move away from other busy area airports. Thus, applying a 2.5 percent average annual growth rate yields approximately 327,500 operations by 2020.

Also considered was the forecasted operational levels for Chandler Municipal Airport presented in the **1993 MAG RASP Study**. The MAG study indicated that operations would reach 242,000 by 2015 equating to an average annual growth rate of 1.26 percent. Projecting out to 2020 at an annual average growth rate of 1.26 percent, the MAG forecast would reach 256,800 annual operations. **Exhibit 2D** and **Table 2J** graphically depicts the operation forecasts developed for Chandler Municipal Airport.

Over the planning period it is expected that the percentage of local operations will remain steady, or increase slightly. Currently, local operations constitute 60 percent of annual airport operations. According to the **FAA Aviation Forecasts-Fiscal Years 1996-2007**, local general aviation operations are projected to increase at contract

towered airports by an average annual rate of 2.19 percent. Itinerant operations, on the other hand, are expected to increase at a slower annual rate of 2.0 percent. Utilizing the FAA's forecasted rate, forecasts for local annual operations would reach 64.85 percent of the total annual operations.

TABLE 2J
Annual Operations Forecast Summary
Chandler Municipal Airport

	2005	2010	2015	2020
MAG RASP Forecast*	212,900	226,600	242,000	256,800
Average Annual Increase of:				
FAA's 2.12 percent	220,300	244,600	271,700	301,800
2.5 percent	226,000	256,000	289,400	327,500

* Forecast for year 2010 & 2020 extrapolated by Coffman Associates

The higher percentage of local operations will likely occur as a result of the increased utilization of the airport for training purposes by aircraft from area airports or if the FBI relocates their training operation to the airport. The increased utilization of the airport by corporate aircraft will help keep the local operation mix percentage from increasing a significant amount. However, it can be expected that local operations could reach 64 percent of total annual operations by the end of the planning period.

As indicated previously, the time-based projections of anticipated growth should serve only as a guide. Actual activity may fluctuate above or below the lines graphically depicted on **Exhibit 2D**. In order to develop a master plan that is demand-based rather than time-base, the forecasts will be related to planning horizon milestones as follows:

- Short Term
  135,000 Local
  72,000 Itinerant
  190,000 Total

- Intermediate Term
  160,000 Local
  90,000 Itinerant
  230,000 Total

- Long Range
  192,000 Local
  108,000 Itinerant
  300,000 Total

MILITARY ACTIVITY

Military operations comprise a small portion of the operations at Chandler Municipal Airport. FAA **Form 5010** and ADOT information has estimated that military operations comprise less than 100 annually. Also, actual tower counts have indicated that 118 military

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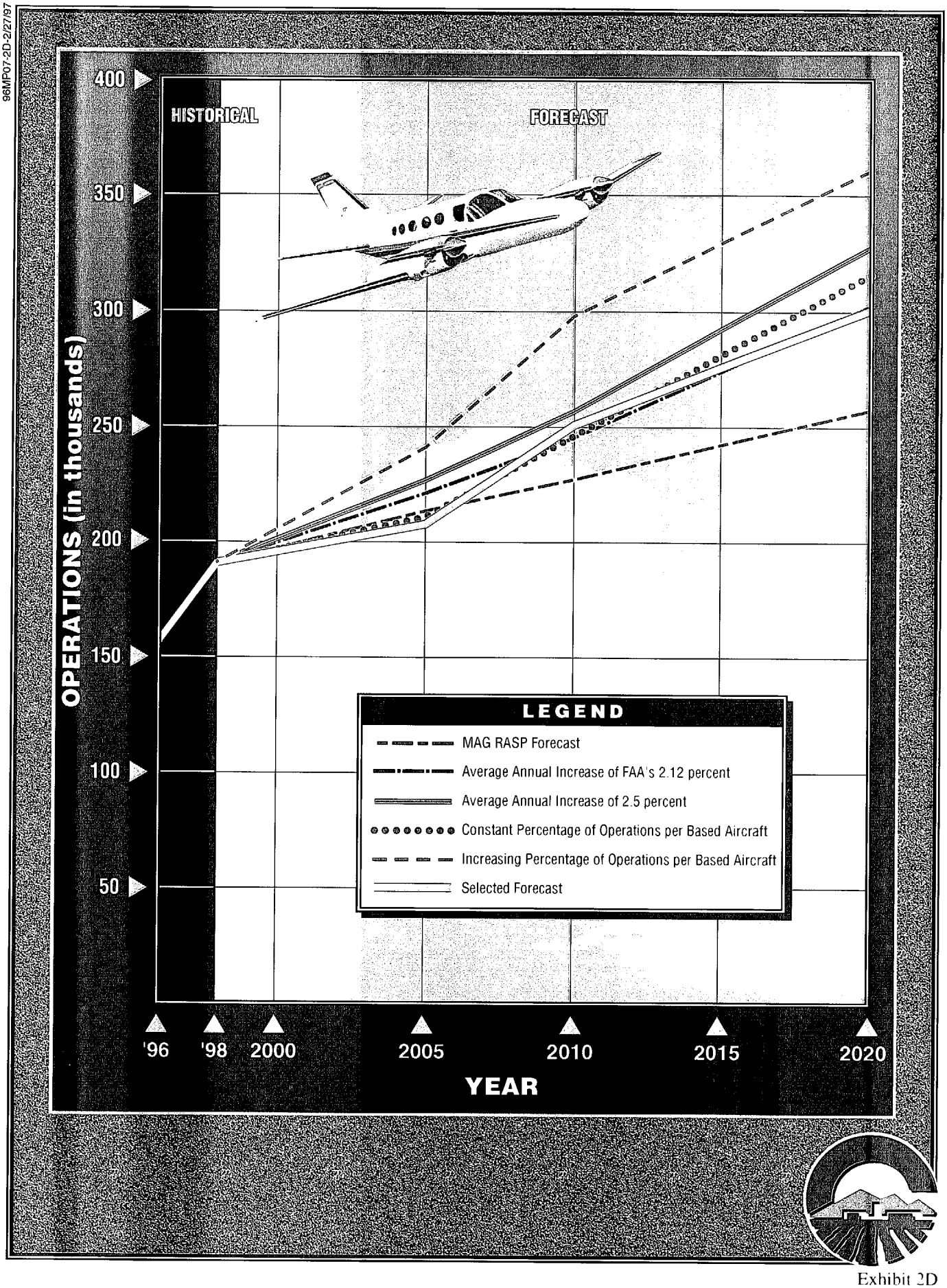

Exhibit 2D
ANNUAL OPERATIONS PROJECTIONS

operations (predominantly helicopter operations) were conducted in 1996. While activity is dependent upon future requirements of the Department of Defense, there is no indication that military operations at the airport will change dramatically in the future. Therefore, future military activity at the airport is expected to be sporadic and comprise an insignificant portion annual operations and will be factored in with local and transient operations.

PEAKING CHARACTERISTICS

Many airport facility needs are related to the levels of activity during peak periods. The periods used in developing facility requirements for this study are as follows:

- *Peak Month* - The calendar month when peak aircraft operations occur.
- *Design Day* - The average day in the peak month. Normally this indicator is easily derived by dividing the peak month operations by the number of days in a month.
- *Busy Day* - The busy day of a typical week in the peak month. This descriptor is used primarily to determine apron space requirements.
- *Design Hour* - The peak hour within the design day. This descriptor is used primarily in airfield demand/capacity analyses, and in determining terminal building and access road requirements.

It is important to note that only the peak month is an absolute peak within a given year. All the others will be exceeded at various times during the year. However, they do represent reasonable planning standards that can be applied without overbuilding or being too restrictive.

Monthly operation information collected by the air traffic control tower for July 1995 through December 1996 was analyzed to determine the peak month general aviation activity at the airport.

Consideration for the peak month was given to 1998 (June 1997 through May 1998) monthly operation totals only. March was the peak month for the year with 18,916 operations. This peak month can be anticipated to remain around nine to ten percent of the annual total in the future.

The determination of daily peak, or busy periods, provides important information about the adequacy of aircraft parking apron areas. Daily data provided by the Chandler ATCT was used to determine a busy day peaking factor for general aviation activity. According to daily operation totals for the month of March 1996, the peak day of each week for general aviation operations averaged 619 operations or 19 percent of the weekly total. This equates to a busy day which is 33 percent higher than the average, or design day. For planning purposes, this factor is expected to remain relatively constant over the planning period.

Because counts of hourly traffic are not retained by the tower, historical information is not available. Discussions with ATCT staff, however,

indicate that hourly operations typically range between 45 and 60 during daylight hours. Also, ATCT indicated that peak hours can measure above 100 operations. Typically, design hour operations for similar size and type airports equal 10 to 20 percent of the design day operations. Because there are no special considerations at the airport which would factor into a lower or higher hourly totals, design hour operations were considered to be 18 percent of design day operations. This percentage can be expected to decrease in the future as operations increase and peak periods spread. **Table 2K** summarizes the peak activity forecasts for the airport.

TABLE 2K
Forecast of Peak Activity
Chandler Municipal Airport

	1998	Short Term	Intermediate Term	Long Range
Annual Operations	190,192	207,000	250,000	300,000
Peak Month	18,900	20,700	25,000	30,000
Design Day	631	690	830	1,000
Busy Day	820	895	1,090	1,300
Design Hour	126	140	165	200

ANNUAL INSTRUMENT APPROACHES

Forecasts of annual instrument approaches (AIA's) provide guidance in determining an airport's requirements for navigational aid facilities. An instrument approach is defined by the FAA as "an approach to an airport with the intent to land by an aircraft in accordance with an Instrument Flight Rule (IFR) flight plan, when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude".

Historical data available through the **FAA Air Traffic Activity** statistics was limited for Chandler Municipal Airport. Thus, AIA's conducted at other area airports were examined in order to project future AIA's at the airport.

Chandler Municipal Airport will be increasingly utilized by larger and more sophisticated aircraft. Also, the increased availability of low cost navigational equipment could allow for smaller and less sophisticated aircraft to utilize instrument approaches. Also, an examination of AIA's conducted at other area airports indicates that AIA's constitute approximately 0.2 percent to 0.3 percent of annual itinerant operations. Therefore, for planning purposes a percentage of 0.2 percent increasing to 0.3 percent of annual itinerant operations was applied to forecast future AIA's as presented in **Table 2L**.

FORECAST SUMMARY

This chapter has outlined the various aviation demand levels anticipated over the planning period. In summary, general aviation activity at Chandler Municipal Airport has not followed the national trends. The airport has growth potential for both based aircraft and general aviation operations, due to a growing local economy and population. In addition, local commercial and industrial growth will influence future activity and based aircraft levels.

Table 2L provides a summary of the aviation activity planning horizons for Chandler Municipal Airport. Actual activity for 1998 is included in the table as a baseline reference. The planning horizons are used to emphasize the master plan will be developed according to a demand-based schedule rather than a time-based one.

The next step in the master plan is to assess the capacity of existing facilities to accommodate forecast demand and determine which facilities will need to be improved to meet these demands. This will be examined in the next chapter -- **Chapter 3, Facility Requirements.**

TABLE 2L
Summary of Aviation Activity Planning Horizons
Chandler Municipal Airport

	Actual 1998*	Short Term	Intermediate Term	Long Range
Annual Operations				
Itinerant	68,738	72,000	90,000	108,000
Local	121,454	135,000	160,000	192,000
Total Operations	190,192	207,000	250,000	300,000
Based Aircraft	254	300	350	450
AIA's	N/A	144	225	325

* June 1997 through May 1998 data.